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**REMARKS**

The Examiner is thanked for the courtesy extended during an interview in the Examiner's office on June 15, 2004. Present at the interview were the Examiner, Dr. Baker, and the undersigned attorney for applicant. While no agreement was reached with respect to the allowance of this application, an agreement was reached with respect to the amendments applicants agreed to make herein.

By way of the present communication, applicants have amended the paragraph starting on line 13 of page 12 of the instant specification to include language with respect to the ratio of CO when used as the carbon containing gas, which language is taken from claims 42 and 44. It is requested that the Examiner enter this amendment to the specification. No new matter is being added.

Also, by way of the present communication, applicants have amended claim 27 by: i) requiring that the powdered metal catalyst be *unsupported* (support for this can be found in the paragraph starting on line 21 of page 7 of the instant specification); ii) by eliminating the functional language with respect to the dispersing agent and limiting it to one selected from alkaline halides, alkaline-earth halides, and metal oxides (support for this can be found in canceled 33 as well as the paragraph that starts on line 21 of page 10 of the instant specification; iii) requiring that the dispersing agent, during milling, keeps the metal powder particles from agglomerating (support for this can be found on lines 18-20 of page 11 of the instant specification); and (iv) requiring that the dispersing agent be discrete from the powder metal catalyst particles (support can be found in the functional language deleted from claim 27 as well as lines 28-30 of page 11 of the instant specification that states that it is preferred that the dispersing agent be removed from the system after the catalyst has been used to grow carbon nanofibers).

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Claims 42 and 44 have also been amended to indicate that the carbon-containing gas is decomposed in the presence of hydrogen. Support for this can be found in the second full paragraph of page 12 of the instant specification, as well as throughout the examples. Applicants have also: amended claim 45 to be dependent on claim 27 instead of on claim 14; amended claim 46 to be dependent on claim 39 and not claim 45; and amended claim 47 by including the limitation that helium is present with hydrogen during the step of reducing the milled, calcined mixture of catalyst particles. Support for this can be found in the instant examples.

Claim 50 has been canceled because its' limitation is already present in claim 27 and claim 31 has been canceled and its limitation with respect to the dispersing agent is incorporated into claim 27. Applicants have added claim 51 to include preferred alkaline-earth halides.

It is respectfully requested that the Examiner enter all of these amendments since none of them present new matter and instead limit the claims in order to better define the instant invention over the cited art.

Claims 27-30 and 32-49 and 51 are presently in the application and under prosecution.

**Rejection under 35 U.S.C. 112, second paragraph:**

Claims 42-47 and 50 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that applicants regard as their invention.

Claims 42-44 were rejected for lacking antecedent basis for the "ratio" language and claims 45 ad 50 were rejected because the Examiner believes that they should depend on claim 27 and not claim 14.

Applicants have amended claims 42-47 as indicated above so that they are now in compliance with 35 U.S.C. 112, second paragraph. For example, claims 42 and 44 now recite that

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CO is present as the carbon-containing gas in the presence of hydrogen, which by definition will be present in a ratio. Claim 50 has been canceled.

In view of the above, it is requested that the Examiner withdraw the rejections under 35 U.S.C. 112.

**Rejection Under 35 U.S.C. 103(a)**

Claims 27, 31 and 35-50 have been rejected under 35 U.S.C. 103(a) as being unpatentable over the Kim et al. article taken with Sawyer et al. (USP 4,828,676).

**Examiner's Position**

It is the Examiner's position that the Kim et al. article teaches making carbon nanotubes using an Fe-alumina catalyst. The Examiner indicates that page 100 of the Kim et al. article teaches that the particle size can be optimized to make the desired product, thus the Examiner believes that the claimed milling step is suggested by Kim et al. The Examiner continues by saying that Kim et al. do not teach catalyst synthesis, but cites Sawyer et al. for doing same. The Examiner's position is that using the synthesis of Sawyer et al. to make the presently claimed catalyst, and grinding it, is an obvious expedient to making an effective catalyst taught by Kim et al. The Examiner also believes that the CO-hydrogen ratio is a matter of routine optimization.

**Applicants' Position**

It is applicants' position that neither references alone, or in combination, teach nor suggest, the instantly claimed invention. The statement in Kim et al. that *"The diameter of the nanofiber formed is directly dependent on the size of the catalyst particle and this parameter can easily be controlled by careful choice of pre-treatment conditions."* relates to conventional techniques known at the time (1995) the Kim et al. paper was written. This was conventionally accomplished by: a) heating in the presence of a halogen gas, such a chlorine, which effectively disperses the metal particles via the formation of volatile metal chlorine; or b) the inclusion of

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hydrogen in carbon-containing gaseous reaction mixture that acts to exert an impact on the shape of the metal catalyst particle, thereby modifying the structure of the carbon nanofiber. It has been known for many years by those having ordinary skill in the art that the diameter of a carbon nanofiber was dependent on the size of the catalyst particle from which it is grown. While attempts have been made to produce carbon nanofibers having narrow widths, none have taken the approach as instantly claimed wherein a dispersing agent is used as a physical barrier to prevent agglomeration of catalyst particles.

In Kim et al., Fe is dispersed on  $\gamma$ -alumina as a supported metal catalyst system to grow carbon nanofibers (p 103) and as stated in the **Description of Related Art** of the instant application, this is the conventional method that is followed in order to obtain small metal particles and ultimately narrow width carbon nanostructures. Under such circumstances the weight percent of active metal catalyst is generally of the order of about 10% or less, so that the support medium constitutes about 90% of the catalyst system. Thus, there is no suggestion of the presently claimed invention in Kim et al., which presently claimed system is an unsupported system.

Sawyer et al. relates to a process for the production of high octane gasoline in a process containing multiple steps with a variety of catalyst. For example, a hydrocarbon stream containing sulfur and/or nitrogen, fused multi-ring aromatics including those containing and two, and three or more rings is first hydrogenated to remove sulfur and nitrogen and to hydrogen one of the rings. The hydrogenated stream is then hydrocracked to crack fused multi-ring aromatic hydrocarbons containing three or more rings. The hydrocracked stream is then separated into two a first stream rich in fused two-ring aromatics having a boiling range from about 400°F to about 600°F and a second stream rich in fused multi-ring hydrocarbons containing three or more rings and having a boiling range from about 600°F to 750°F. The stream rich in two-ring hydrocarbons is then contacted with a catalyst comprised of Fe and one or more alkali or alkaline earth metals. The stream rich in fused multi-ring (3 or more rings) is

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hydrocracked over a hydrocracking catalyst. Thus, one can have 4 different reaction zones containing 4 different catalyst systems for producing high octane gasoline from a relatively heavy naphtha feedstream.

It is applicants' position that the Sawyer et al. reference is from a non-analogous art. That is, one having ordinary skill in the art of producing carbon nanostructures from a carbon-containing gas at temperatures from about 842°F (450°C) to about 1,472°F (800°C) would not look to the petroleum refining art that using entirely different feedstocks to produce entirely different products (liquids and gases), at entirely different temperatures and with entirely different catalysts, for a teaching for producing solid sub-micron size carbon structures.

Even if Sawyer et al. can be considered a teaching from an analogous art it still fails to teach or suggest the instantly claimed invention wherein a dispersing agent is used as physical barrier to prevent agglomeration of catalyst particles that are to be used for the production of carbon nanofibers.

Therefore, it is respectfully requested that the Examiner reconsider and withdraw this rejection.

For the foregoing reasons, it is applicants' position that the claims, as now presented, define a patentable invention over the cited art. Therefore, applicants request that the Examiner pass this application to allowance.

Respectfully submitted,

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By 

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